

The type is 175025 A.N.S.P. from Boynton Beach, Palm Beach County, Florida. Paratypes in the McGinty collection.

This attractive little shell has only been taken occasionally on the lower Florida east coast. The encircling grooves covering the whole surface of each whorl easily distinguish it from *Sigatica semisulcata* (Gray), in which there are spirals below the suture and in the umbilicus, but none over the middle part of the last whorl (Pl. 12, fig. 12). This appears to be a constant character of *semisulcata*.

S. semisulcata was dredged by the writer off Boynton Beach on sand bottom in about twelve fathoms. The operculum is corneous, yellowish and simple, not unlike that of *Polinices lactea*, and the shell is wholly external, as in that species. Dr. Pilsbry informs me that the reference of *S. semisulcata* to *Eunaticina* in the current literature is an error. That is a Pacific genus, not known from the West Indies, at least in the present fauna. *Sigatica* comprises Naticidae with the figure of *Polinices*, but the suture is deeply impressed and there is a sculpture of spiral grooves.

NEW MOLLUSKS OF THE GENUS *NAESIOTUS* FROM ECUADOR¹

BY HARALD A. REHDER

In determining a large number of specimens of bulimulids from Ecuador sent to the National Museum by Mr. Ralph W. Jackson of Dorchester, Maryland, it was discovered that several lots represented new subspecies. Moreover, in determining the generic relationships of these shells several facts were uncovered and conclusions reached that seem worth putting on record.

This highly interesting and valuable material consisted of five large lots of what has been called *Bulimulus quitensis* Pfeiffer and *Bulimulus catlowiae* Pfeiffer, collected at various localities in the high interandine plateau of Ecuador between the eastern and the western Andes. Further material of this same group was present in the collection of the National Museum, and some was borrowed from the Museum of Comparative Zoölogy at Harvard University, through the kindness of Mr. William J. Clench.

¹ Published by permission of the Secretary of the Smithsonian Institution.

In 1848² Pfeiffer described two species of *Bulimulus* from the Cuming collection as *Bulimus quitensis* and *Bulimus irregularis*, both stated to have been collected near Quito, Ecuador, by De Lattre. In 1854³ he described a third species, *Bulimus catlowiae*, collected also near Quito by Bourcier. In 1856⁴ Pfeiffer placed all three in *Bulimus*, subgenus *Mesembrinus*, while von Martens, in 1860⁵ placed *catlowiae*, the only species he mentioned, in the subgenus *Scutalus* of the genus *Bulimulus*.

Hidalgo was the first to seriously study these species, and he, after a study of a great many specimens, came to the conclusion that they were variations of a single species.⁶ Pfeiffer, in 1877,⁷ still considered them distinct species, but von Martens in 1885⁸ united *B. catlowiae* with *irregularis*, without having type material at hand. Since the type locality is not known exactly (the localities "near Quito," or, "near Bogota," given by early collectors in northwestern South America, are to be taken only in the broadest sense), we must be content with the literature on the subject, and the specimens at hand. Fortunately I was able to consult large suites of specimens of this group, one lot having been collected only ten miles or less from Quito. With all this material available I have come to agree with Hidalgo, von Martens, and Pilsbry,⁹ that the three species described by Pfeiffer are merely variations of one species, which will bear the name *Naesiotus quitensis*.

Pfeiffer originally placed his three species in the genus *Bulimus*, and later authors assigned them to the groups *Mesembrinus* and *Scutalus*. Pilsbry, in his epochal monograph of the Bulimulidae in the Manual of Conchology, placed *B. quitensis* in *Bulimulus*, section *Lissoacme*,¹⁰ not knowing the nature of the nuclear sculpture; in the following volume¹¹ he placed *B. irregularis* and

² Proc. Zool. Soc. London, pt. 15, 1847, pp. 230, 231 [1848].

³ *Op. cit.*, pt. 20, 1852, p. 154 [1854].

⁴ Malakozool. Blätter, vol. 2, pp. 158, 159.

⁵ Albers, Die Heliceen, ed. 2, p. 218.

⁶ Journal de Conch., vol. 18, 1870, p. 63.

⁷ Monogr. Helic. viv., vol. 8, 1877, pp. 157, 171.

⁸ Conch. Mittheil., (vol. 2), p. 162.

⁹ Man. of Conch., ser. 2, vol. 11, 1897, p. 34.

¹⁰ *Op. cit.*, vol. 10, 1896, p. 158.

¹¹ *Op. cit.*, vol. 11, 1897, p. 34.

its variety *catlowiae*, in *Bulimulus*, subgenus *Scutalus*, and stated there that *Bulimulus quitensis* was specifically identical with these forms, which had a nucleus that was minutely lineolate-punctate.

An examination of the nucleus of these forms, however, shows that the sculpture consists of regular straight axial riblets. This sort of apical sculpture is found in three or more less isolated groups of Bulimulidae: *Protoglyptus* from eastern South America and some of the Lesser Antilles; *Orthotomium* from central and northern Mexico, Lower California, and the southwestern United States, and *Naesiotus* from the Galapagos Islands. Both in the character of the shell and in geographic distribution, *Bulimulus quitensis* is closest to *Naesiotus*, and indeed it so closely resembles some forms from the Galapagos that I cannot see any super-specific difference, and I am therefore placing this species in *Naesiotus*.

The presence of *Naesiotus* on the west coast of South America is another bit of evidence in favor of the hypothesis that the geographic range of the ancient stock of bulimulids with straight axial riblets on the nuclear whorls once extended pretty well over the region from northern Mexico south to the Argentine and Peru. Then during the Tertiary several of these regions were isolated and there developed the groups named above; namely, *Orthotomium*, *Protoglyptus*, and *Naesiotus*, all differing slightly from each other but all obviously related.

The origin of the fauna and flora of the Galapagos is still a matter of dispute. The theory has long been held that it is an adventitious fauna, brought to the islands by wind and currents. However, the cold north sweeping Humboldt current that bathes the shores of this group cannot explain the presence of forms, such as the reptiles, with Central and northern South American affinities. Furthermore, the land tortoises and reptiles can hardly have been brought over by the agency of the wind. *Naesiotus* could have been carried to the islands by wind only if this group had formerly occupied the western slopes and coastal foothills of the Andes. At present it lives in the interandine plateau, separated from the coastal regions by the high western Andes.

The hypothesis is gaining credence that these islands were once connected to the mainland. We have evidence of considerable

crustal movement along the west coast of South America during the middle and late Tertiary, and although very little is known as to the exact geological history of these movements, it is very possible that the islands were separated from the mainland by a subsidence or a down-faulting of the intervening area, and that then the island land mass gradually subsided, leaving above the surface of the water only the mountain tops to which the animal life gradually withdrew as the land subsided. Later the islands rose again, as is evidenced by the presence of fossiliferous beds on Albemarle, Indefatigable and Seymour Islands, of which some at least are of Pliocene age, and which are both underlain and overlain by lava deposits. Whether there were more periods of submergence and emergence than these is not known. This hypothesis is supported by the fact that in several groups, such as *Naesiotus*, for instance, each island bears distinct races belonging to one species, or a group of interrelated species, both cases being the results of isolation.

We, therefore, have a large group of very diversified species of *Naesiotus* in the Galapagos Islands, bearing the marks of long isolation, and another smaller complex of *Naesiotus* in the Andes, showing a trend towards diversification, and, therefore, also isolated there for a considerable period of time.

I am using the generic term *Naesiotus*, as I believe that the extensive genus *Bulimulus* as now conceived may well be broken up into several genera based in general on apical sculpture. Thus *Naesiotus* would be the name for those possessing an axially ribbed nucleus, with *Orthotomium* and *Protoglyptus* as subgenera, while *Bulimulus* would be restricted to those with crowded, irregular and zig-zag riblets on the nuclear whorls.

NAESIOTUS QUITENSIS Pfeiffer.

Shell elongate-ovate to conic-ovate, rather small, 17 to 32 mm. high, of moderately stout texture, composed of about 7, slightly convex whorls, separated by a moderately impressed suture. The $1\frac{3}{4}$ nuclear whorls have slender, straight, regularly spaced and rather separated, axial riblets; the postnuclear whorls are more or less rugosely wrinkled along the lines of growth. The color varies from pale flesh-color and whitish straw-yellow to dark brown or vinaceous. The pale forms may be streaked with brown and the darker specimens are often finely streaked with white.

The umbilicus is narrow or more widely open and slightly covered by the slightly expanded columellar portion of the lip. The aperture is ovate, the lip simple, unreflected.

This species inhabits the interandine plateau of Ecuador, from Otavalo and Ibarra, Prov. del Imbabura, south to near Riobamba, Prov. del Chimborazo. This narrow area, about 150 miles long and 30 to 40 miles wide, lies in the arid temperate life zone at an elevation of between 9,000 and 12,500 feet, between the main chains of the Andes, the western and the eastern Andes. Within this region *Naesiotus quitensis* has become broken up into several geographically localized subspecies.

NAESIOTUS QUITENSIS QUITENSIS Pfeiffer. Pl. 13, figs. 2-4, 7-9, 11, 13, 15, 16, 18, 20.

The form that I am calling the typical *quitensis* occurs in two phases, apparently living together. One, which may be known as the *quitensis* or light phase (figs. 7-9), is pale brown or light straw-yellow, and the specimens usually have darker brown axial streaks; the interior is pale except where the axial streaks show through. The other color form, the *irregularis* or dark phase (figs. 2-4), resembles the original figures of *Bulimus irregularis* Pfeiffer and *B. catlowiae* Pfeiffer, and varies in color from pale flesh-color to dark brown, occasionally ornamented with darker streaks. There are, however, intermediates between these two phases and as the two color forms apparently are found in the same colony, I hesitate to separate them. The spire may have a bluish tinge and the nuclear whorls are either pale yellowish or darker vinaceous brown; the apical color is independent of the depth of color of the later whorls. The interior of the shells is of a vinaceous brown color.

The height of two hundred measured specimens varied from 17.2 to 26.6 mm., and the diameter from 8.4 to 14.1 mm. The average dimensions of these specimens were: Height, 21.8 mm.; diameter, 11.2 mm. In comparing these measurements with those given by Pfeiffer for his species, it must be borne in mind that the older authors generally did not measure their shells as we do now, and hence their measurements may be at variance with ours.

Several hundred specimens of this form were examined by me which were collected on the slopes of the Volcano Pichincha, 9-10 miles northwest of Quito, at an elevation of about 12,000 feet.

A second large lot of specimens, which I am for the present referring here, comes from near Pillaro. These shells are larger and slightly more slender, possibly due to their inhabiting a lower elevation and consequently enjoying a warmer climate and a richer vegetation. They have, however, the same coloration, even to being divisible into the two above-mentioned color phases (figs. 11, 13, 15, 16, 18, 19). The measurements of these specimens, which were collected at Pillaro, Prov. de Tunguragua, at an elevation of 7500 feet, were as follows: Height, from 21.0 mm. to 30.2 mm.; diameter, from 11.1 mm. to 14.6 mm. The average measurements are: Height, 26.1 mm.; diameter, 12.7 mm.

The rather striking difference in size, and the distance between them, about 66.5 miles, make it possible that we are dealing here with a distinct race, but only further collections in the intervening area will determine this question.

Two specimens, M.C.Z. No. 113824, from Caucagua, Ecuador, seem to belong here.

NAESIOTUS QUITENSIS JACKSONI, new subspecies. Pl. 13, figs. 1, 5.

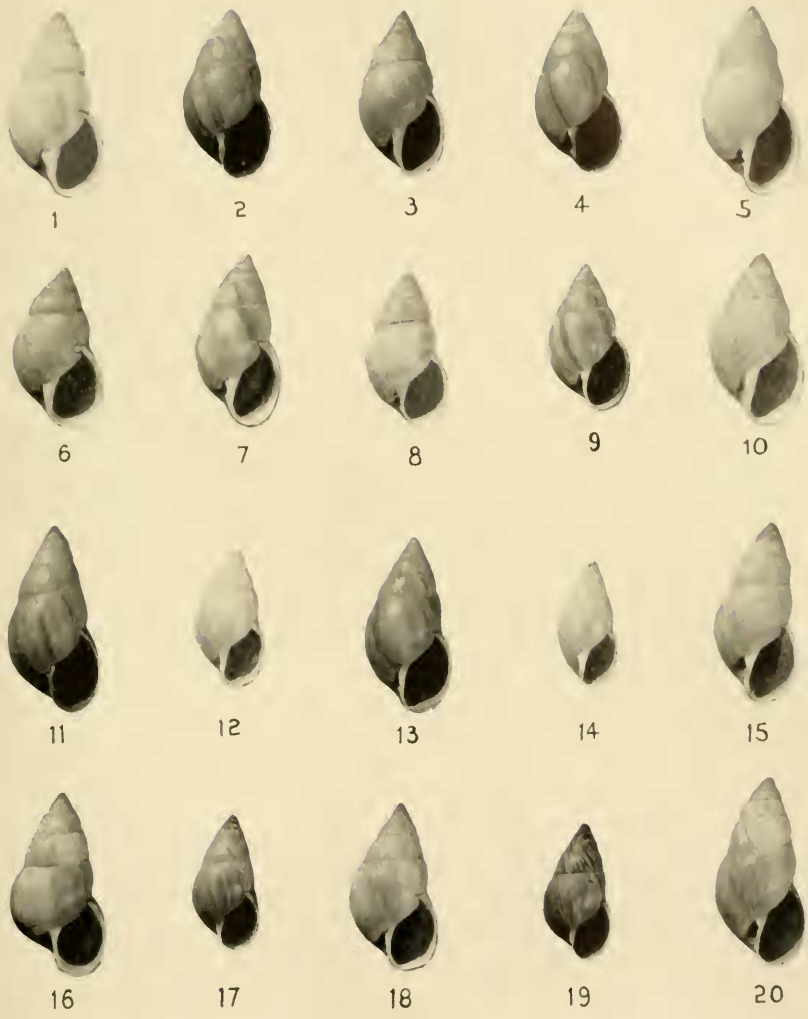
This form is always pale, varying from very pale flesh-color to light straw-color, occasionally with axial streaks of darker brown. The nuclear whorls may be pale or darker flesh-color. The shells are generally larger and slightly more slender than the typical form, as is evident from the average measurements given below. The aperture may be whitish with the darker brownish streaks showing through, or the whole interior may be suffused with a more or less brown-vinaceous hue.

The type, U.S.N.M. No. 473969, measures: Height, 28.9 mm.; diameter, 14.1 mm. The measurements of a hundred specimens range as follows: Height, from 23.5 to 32.4 mm.; diameter, from 11.6 to 14.8 mm. The average measurements are: Height, 26.9 mm.; diameter, 13.1 mm.

This form was collected from Guailabamba (or, as it is occasionally spelled, Huayabamba), Prov. del Pichincha, some 22 miles northeast of Quito on the western slope of the eastern Andes.

NAESIOTUS QUITENSIS ORINUS, new subspecies. Pl. 13, figs. 6, 10.

This race represents a rather short stout form which is of a dirty pale straw-color, and slightly more rugose than the other



FIGS. 1, 5, *Nautilus quitensis jacksoni*. FIGS. 2-4, 7-9, 11, 13, 15, 16, 18, 20, *N. q. quitensis*. FIGS. 6, 10, *N. q. orinus*. FIGS. 12, 14, *N. q. ambatensis*. FIGS. 17, 19, *N. q. vermiculatus*.

